THE STRATIGRAPHY OF THE WALNUT FORMATION

IN

LAMPASAS, WILLIAMSON, TRAVIS, HAYS, AND COMAL COUNTIES, TEXAS

Approved:

[redacted]

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Dean of the Graduate School.

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LAMPASAS, WILLIAMSON, TRAVIS, HAYS, AND COMAL COUNTIES, TEXAS

THESIS

Presented to the Faculty of the Graduate School of
The University of Texas in Partial Fulfillment of the Requirements

For the Degree of

MASTER OF ARTS

By

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Preface

The study to which this paper is devoted was suggested by Dr. F. L. Whitney, and any degree of success that I may have attained is due to his untiring assistance, constructive criticism, advice, and unstinted encouragement. I wish to thank Mr. C. H. Sample for his invaluable assistance with the diagram.

The writer wishes to express his gratitude also to Dr. F. W. Simonds for the use of his private library.

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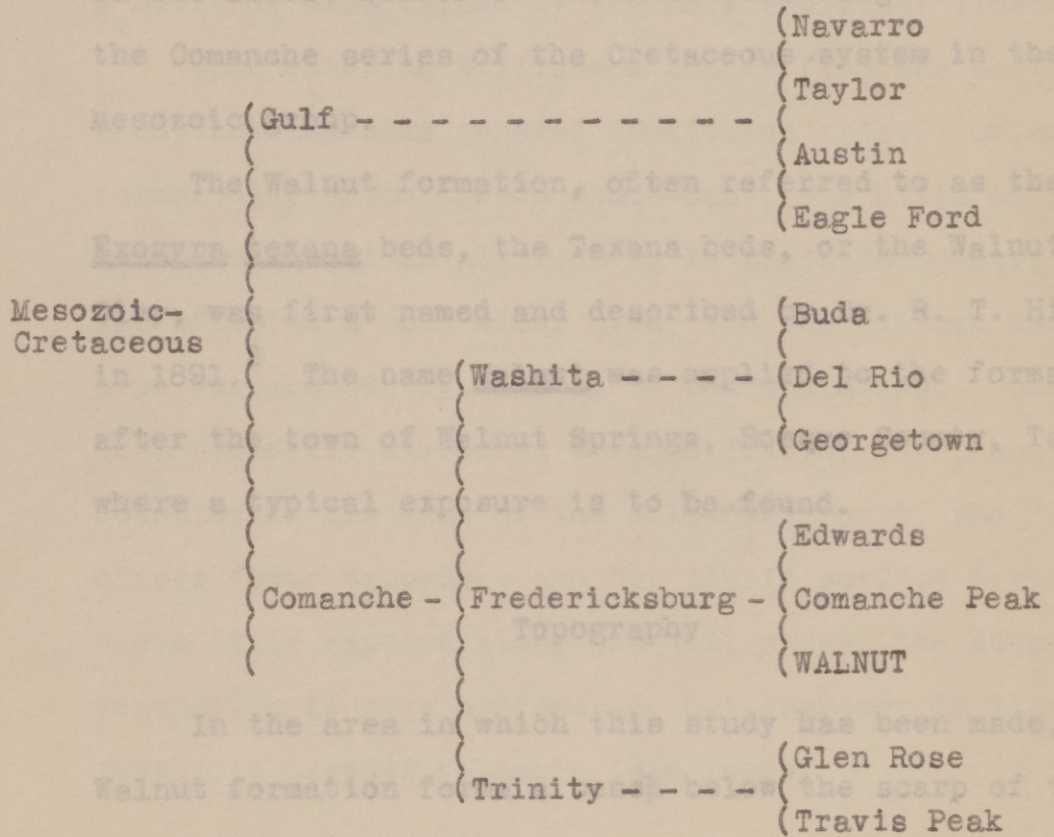
Diagram

The Cretaceous Formations Exposed in the Coastal Plain of Texas West of the Brazos River[1]



[1] Deussen, Alexander: "Geology of the Coastal Plain of Texas West of the Brazos River," United States Geological Survey, Professional Paper, #126. p. 623. 1924.

Introduction

The Walnut formation rests on the Glen Rose formation and is capped by the Comanche Peak formation. It is the lowest member of the Fredericksburg division of the Comanche series of the Cretaceous system in the Mesozoic group.

The Walnut formation, often referred to as the Exogyra texana beds, the Texana beds, or the Walnut Clay, was first named and described by Dr. R. T. Hill in 1891.[2] The name Walnut was applied to the formation after the town of Walnut Springs, Bosque County, Texas, where a typical exposure is to be found.

Topography

In the area in which this study has been made, the Walnut formation forms a bench below the scarp of the Comanche Peak limestone.

In Lampasas County, this formation is well exposed in nearly all of the many buttes and mesas which dot the sky line. Because this formation and the Glen Rose formation beneath it are much softer than the overlying Edwards, they are much more susceptible to the effects

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[2] Hill, R. T., The Comanche Series of the Texas - Arkansas Region, Geological Society of America, Volume 2, 1891, pp. 503 - 512.

of erosion. Consequently, wherever a break in the harder limestone has been effected, more rapid erosion has lowered the general surface level some one or two hundred feet, thereby developing a dissected plateau, with here and there a butte or mesa capped by the more resistant limestone.

Upon entering Williamson County from the north, we find that the same general conditions exist. Owing to the normal dip, which trends south-east, the hills do not attain so great an altitude as in Lampasas County; erosion has affected a much wider area; and the plateau has a more even surface gently sloping to the south-east. Continuing in a southerly direction through Travis, Hays, and Comal counties to the west of the Balcones fault, the formation offers fewer exposures and but little surface distribution. Where it is exposed along the hill sides, the absence of vegetation is very noticeable, but wherever it lies fairly level, it creates valuable farm lands.

Lithology

The Walnut formation is composed of alternating beds of clay and limestone at the base of the Fredericksburg division. These consist of alternations of calcareous laminated clays, weathering yellow on oxidation, semi-crystalline limestone in alternating massive, nodular, flaggy beds and shell agglomerate; all of which grade

upward into the more chalky nodular beds of the Comanche Peak formation.

Throughout the section, in both clays and limestones occur many Exogyra texana, Roemer, and Gryphaea marcoui, Hill & Vaughan. Especially in the lower and upper clay members there is a great abundance of Exogyra texana, Roemer. It is due to the presence of these Exogyra texana clay beds that the name "Texana Beds" has been applied.

Alternating with the clay throughout the section are to be found ledges of hard limestone with a thickness of from three or four inches to as much as six or seven feet, composed entirely of Gryphaea marcoui, Hill & Vaughan. Near the top of the section, there is a nodular limestone containing the cephalopod, Oxytropidoceras acutocarinatum, which has proven to be an unfailing marker throughout Lampasas and Williamson counties. In Hays and Comal counties this fossil does not appear, since this member of the formation completely disappears in northern Travis County.

The uppermost bed of the section consists of a soft, nodular limestone which breaks down into marly material, closely packed with Gryphaea marcoui of all sizes to a maximum of about two inches in length.

Upon weathering, the Walnut formation disintegrates into very rich, dark, chocolate-colored calcareous soil.[3]

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[3] Hill, R. T., U. S. Geological Survey, Twenty-First Annual Report, Part 7. "The Geology of the Black and Grand Prairies." 1900.

Stratigraphy

All former studies of the Walnut formation have been only general; and geologists have given its thickness in amounts varying from a few feet to as much as two hundred feet according to the location of the sections measured. The maximum for Lampasas County has been given as 80 feet; for Williamson County, about 100 feet; and for Travis County, 32 feet. Continuing southward, the formation gradually thins out until, at the Nueces River, it is represented by about one or two feet of the clay bed containing Exogyra texana, Roemer.[4]

The following sections were measured by Dr. R. T. Hill and Mr. J. A. Taff.

"Section 20

Bosque River Valley

As measured by Mr. J. A. Taff
and reproduced by Dr. R. T. Hill.

"Comanche Peak Formation:

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[4] Hill, R. T., op. cit.

Hill and Vaughan, "Geology of the Edwards Plateau and Rio Grande Plain Adjacent to Austin and San Antonio, Texas", United States Geological Survey, Eighteenth Annual Report, Volume #2; June 30, 1897.

Taff, J. A., "Cretaceous Area North of the Colorado River," Fourth Annual Report of the Geological Survey of Texas, 1892.

Calcareous and argillaceous, chalky, white and light blue limestone, which contains, in its upper portion, Exogyra texana, in their greatest development in point of size, Enallaster texanus, Epiaster elegans, Holectypus planatus, Sphenodiscus pedernales, Gryphaea marcoui, and casts of gastropods - - - - - - - - - - - - - 15' 0"

"Walnut Clays:

Uppermost Gryphaea marcoui zone; compact thin layers of limestone. The fossils are small and are cemented in hard limestone - - - - - - - - - - - 3' 0"

Marly white to buff limestone, bearing but few fossils. Fragments of oyster shells and fossil casts occur. On weathering, the marly limestone breaks up into soft marl and angular balls of marly lime - - - - - - - - - - - 25' 0"

Middle Gryphaea marcoui zone; composed of layers of hard semicrystalline lime, bearing numerous individuals of small Gryphaea marcoui fossils - - - - - - - - - - - 3' 0"

Marly limestone beds. The limestone layers composing this bed are of varying thickness. Occasional hard bands project from the surface and leave fragments of limestone on the sloping hillsides - - - - - - - - - - - 30' 0"

Soft, marly and compact semicrystalline limestone in alternating layers, varying in thickness from very thin bands to beds 3 to 4 feet thick - - - 35' 0"

"Glen Rose Formation -

"The upper portion of this section is composed of massive white limestone differing little in character from the superimposed Comanche Peak limestone. Near the base the limestone is in the form of thin beds, blue in fresh exposures, turning to a cream or yellow color on long weathering. It contains considerable clay apparently, and in some instances small quantities of petroleum. The lower portion contains few fossils.

"Many of the hard bands of limestone are agglomerates of Gryphaea marcoui, which, in some instances, compose almost the whole rock. The fossils Exogyra texana and Gryphaea occur abundantly in this bed, but Exogyra texana is most numerous at and near the base, while Gryphaea is most abundant at the top."[6]

"Cleburne Section

As given by Mr. J. A. Taff

"Texana limestone in Comanche Peak, in descending order; hard and yielding limestone.

Hard limestone which bears numerous small Gryphaea pitcheri at upper edge - - - - - - -	3' 0"
Friable marly limestone in which are Gryphaea pitcheri - - - - - - - - - - - - - - -	8' 0"
Ledge of hard limestone - - - - - - - - - - -	1' 0"

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[6] Hill, R. T., op. cit., p. 206.

Marly limestone weathering easily; contains Gryphaea pitcheri - - - - - - - - - 5' 0"

Hard limestone layer - - - - - - - - - - - - 1' 0"

Marly limestone, exhibiting chalky character in the upper portion - - - - - - - 15' 0"

Flaggy limestone containing Gryphaea pitcheri - - - - - - - - - - - - 1' 0"

34' 0"

Arenaceous and argillaceous lime marl, with layers of harder limestone. Argillaceous lime marl grading downward into arenaceous laminated marl in basal portion - - - - - - - - - - - - 20' 0"

Compact argillaceous limestone - - - 1½ to 2' 0"

Argillaceous lime marl with Gryphaea pitcheri - - - - - - - - - - - - 3' 0"

Thin compact limestone - - - - - - - - - - - - 1' 0"

White marly limestone - - - - - - - - - - - - 5' 0"

31' 0"

Bedded Gryphaea breccia - - - - - - - - - - - - 10' 0"
This rock is composed almost entirely of fossils of Gryphaea pitcheri.

Yielding argillaceous lime marl, bearing numerous individuals of Gryphaea pitcheri - 14' 0"

On the surface, after long weathering, this rock appears as a yellow or light buff friable marl. In fresh exposures it is a compact light blue limestone with softer thin layers of marly lime intervening between the harder and thicker strata.

Marly and hard layers of limestone alternating. Hard Gryphaea pitcheri limestone - 3'0"

Marly lime on weathered surface - - - - - 4'0"

Thin layer of compact limestone - - - - - 1'0"

Marly limestone friable on weathered surface - - - - - 2'0"

Limestone ledges with Gryphaea pitcheri	3' 0"	
Marly limestone with many Gryphaea pitcheri and Exogyra texana; weathers readily into soft material	4' 0"	
Persistent layer of limestone	2' 0"	
		18' 0"
Arenaceous lime marls with Gryphaea pitcheri	15' 0"	
		122'0"

" The basal portion is more arenaceous than the upper and grades downward with increasing proportions of arenaceous material to its contact with the Paluxy sand." [6]

Section

As given by Mr. J. A. Taff

"Details of the upper portion of the Texana limestone two miles east of Benbrook and on Mary's creek two miles northwest of Benbrook, in descending order.

Crumbling chalky limestone which contains Cylindrites formosis, Crag; Enallaster texanus, Gryphaea pitcheri, Diplopodia texanum, Epiaster whitei, Cyprimeria crassa, in the lower part; Schloenbachia acutocarinatus, Sphenodiscus pedernales, Epiaster elegans, Crag; Trichotropis shumardi, Crag; Cinulina tarrantensis,

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[6] Taff, J. A., "Cretaceous Area North of Colorado River," Fourth Annual Report of the Geological Survey of Texas, 1892, pp. 251-252.

Crag; and Turritella seriatim-granulata, in the upper part; Caprina crassifibra was found here 4 feet below the summit of the limestone - - - - - - - - - - - - - - 18' 0"

The upper portion of the above strata above the occurrence of Exogyra texana represents the whole of the Comanche Peak and Caprina limestone at this locality. Stratigraphically, the parting line between the Texana and Comanche Peak limestone is difficult to draw.

Blue argillaceous lime marl - - - - - - - - - - 1' 0"

White crumbling limestone bearing Toxaster texanus, Gryphaea pitcheri, Pecten texanus, Exogyra texana, and Exogyra plexa, Crag - - - 4' 0"

The Exogyra plexa occurs in a narrow band at the base of this bed.

Blue argillaceous lime marl - - - - - - - - - - 1' 6"

Comparatively massive, soft, white limestone, the atrata varying slightly in compactness - - - - - - - - - - 29' 6"

Soft, shelly limestone and blue argillaceous lime interstratified, each stratum being 5 to 6 inches thick - - - - - - - 14' 0"

Massive limestone - - - - - - - - - - 8' 0"

Compact limestone - - - - - - - - - - 2' 3"

Shaly argillaceous limestone - - - - - - - - - - 2' 6"

Compact limestone - - - - - - - - - - 2' 6"

Compact and shaly lime in thin layers - - - - - 2' 0"

Concealed in this section and not examined - - 50' 0"

Gryphaea pitcheri conglomerate, composed of layers of massive shell limestone and lime marl interbedded - - - - - - - 10' to 15' 0"

Alternating chalky and Gryphaea limestone - - - - - - - - - 30' to 32' 0"

Arenaceous marl which contains Gryphaea pitcheri, Exogyra texana, and Sphenodiscus pedernales - - - - - - - - - 3' 0"

"Exogyra texana and Gryphaea are in the marl at the contact of Texana bed and Paluxy sand.

"The Texana limestone decreases rapidly in thickness northward from the Trinity River Valley, and the Gryphaea pitcheri conglomerate gradually approaches the base of the subdivision.

"In Comanche Peak and at other localities cited in the Brazos River Valley, this zone is 45 to 50 feet above the base of the Texana beds, while at Decatur, Wise county, it occurs within 16 feet." [7]

Section

As taken by Mr. J. A. Taff

Twin Sisters Peak, Lampasas County.

Comanche Peak:

"Comanche Peak chalky limestone from the cap of the peak to the top of the Texana bed. Rock soft, white, heavily bedded, and almost pure limestone, except the cap rock, about 8 feet thick, which is an

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[7] Taff, J. A., "Cretaceous Area North of the Colorado," Fourth Annual Report of the Geological Survey of Texas, 1892, p. 254.

indurated chalky limestone - - - - - - - - - 50' 0"

Numerous fossils of Toxaster texanus, Diadema, and gastropods occur at the base of the bed.

Texana Bed - upper to lower limits of the occurrence of the fossil Exogyra texana. The upper 25 to 30 feet is a chalky limestone very much like that of the Comanche Peak. Below this, chalky white to yellow limestone alternate with a marly lime. Exogyra texana and Gryphaea pitcheri shells are very numerous and well preserved near the middle of the bed, but become smaller and less numerous below and above. Ammonites acutocarinatus, Cyprimeria crassa, Arca, Toxaster texanus, Diadema texanum, and gastropods occur in upper chalky limestone - - - - - - - - - 80' 0"

"Glen Rose - - - - - - - - -

Paluxy Sand:

Soft, yellow laminated sand - - - - - - - - - - - - - - -." [9]

Section #6

As Taken by Mr. J. A. Taff

Pilot Knob, Williamson County

"From the top of Pilot Knob to the bed of San Gabriel River below Gabriel Mills.

Caprina limestone. A remnant of the basal flint horizon remains, forming the cap rock of the peak. Many fragments of flint occur upon the surface and in the indurated limestone - - - - - - - - - - - - - - - 10' 0"

"Comanche Peak:

Debris from the Caprina beds and from the surface weathering conceals surface exposures upon the slopes of the peak - - - - - - - - -110' 0"

Texana bed, which is exposed in the slopes and breaks of the San Gabriel river valley, between Pilot Knob and Gabriel Mills. There is but little if any variation in the bed at this locality and in that described under Number 10 of Bachelor Peak section - - - - - - - - - - - - - - 100' 0"

"Glen Rose - - - - - - - - - - - - - - -

"Section

As Taken by Dr. R. T. Hill

"Section at border of Blanco and Travis Quadrangles, four miles south of the Colorado River.

Edwards limestone:

Firm white limestone containing flints 1" thick. This is the lower portion of the Edwards limestone which is here preserved as a cap rock	1' 0"

Comanche Peak:

White chalky limestone	15' 0"
Firm calcareo-siliceous clays containing Exogyra texana	10' 0"

Walnut:

Thin indurated layer	0' 3"
Calcareo-arenaceous clays containing great quantities of Exogyra texana	15' 0"
Yellow, rotten honey combed limestone	1' 0"
Yellow clay with abundance of Exogyra texana	10' 0"
White chalky limestone band with Exogyra texana	2' 0"
Firm limestone	2' 0"
Yellow arenaceous limestone forming ledge	2' 0"

Glen Rose ----------." [11]

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[11] Hill, R. T., "The Geology of the Black and Grand Prairies," U. S. Geological Survey, Twenty-First Annual Report, Part 7. 1900. p. 211.

"Section

As Taken by Dr. R. T. Hill

"From top of high hill south of Round Mountain, east of road from Bee Caves to Lohmann's Crossing on the Colorado River.

"Comanche Peak limestone:

Limestone breaking easily; some firm slabs at top - - - - - - - - - - - - 5' 0"

"Walnut Formation:

Clays with large Exogyra texana; forms a shelf - - - - - - - - - - - - -10' 0"

"Glen Rose: - ." [12]

While conducting the geological field courses of the University of Texas during the summer of 1929, Dr. F. L. Whitney found several species of fossil algae occuring in the upper beds of the Glen Rose and the lower beds of the Walnut formations. Upon further study and careful investigation, he found these same fossil algae appearing in members further up in the section of the Walnut formation. During the summer he had occasion, also, to study the Comanche Peak section, and upon examination, failed to find these algae

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[12] Hill and Vaughan, "Geology of the Edwards Plateau and Rio Grande Plain Adjacent to Austin and San Antonio, Texas," U. S. Geological Survey, Eighteenth Annual Report, Volume #2, June 30, 1897. p. 224.

in any member that is known to be included in the Comanche Peak section.

With the idea that these new species of fossil algae might aid in the establishment of a more definite line of demarkation between the Walnut and the overlying Comanche Peak formation, he gave me the special problem of studying the occurrence of these algae species so as to determine whether they occur any where in the known Comanche Peak formation; and then to show by measured sections and plotted diagrams the thickening and the thinning of the Walnut formation in Lampasas, Williamson, Travis, Hays, and Comal counties of Texas, following as closely as possible a north and south direction.

After careful study in the field, we have not been able to find these fossil algae in any of the known members of the Comanche Peak Formation. In as much as there are several members designated as belonging to the Walnut Formation above the known members which contain these fossil algae, we have been able to measure to a satisfactory degree of accuracy the thickness of several sections throughout the above defined area. Another very definite and persistent marker is the fossil Oxytropidoceras acutocarinatum, which occurs very nearly at the top of this formation. With the indisputable positions of the Exogyra and Gryphaea beds above and below the limestone beds containing these fossil algae, it was

possible to compile notes from which have been developed the accompanying diagram to show the thickening and the thinning of this formation along the line of strike through Lampasas, Williamson, Travis, Hays, and Comal counties. The diagram shows a material thickening of some beds and a thinning, even to the complete pinching out, of other beds at various localities.

The following measured sections are intended to show the development of the various members in the accompanying diagram.

Section #1

Twin Sisters Peaks, Lampasas County

1½ miles north of Nix on Nix - Lometa Road

Top of hill capped with five feet of soft, sandy limestone with flints - - - - - - - - - - 5' - 0"

Comanche Peak:

#7 Below this cap, the rock of the Comanche Peak is chalky and soft. There is some evidence of Gryphaea marcoui up to the Edwards, but the two or three shells that were found may have been carried up there.

A little farther down the slope the Gryphaea become more abundant and Exogyra texana become quite common. At thirty feet below the top there is a break in the limestone and a yellow clay bed three or four feet thick occurs. It contains numerous Exogyra texana, Protocardia texana, Enallaster texanus, Holectypus planatus. No Gryphaea were seen here and as yet no Cephalopods. At 68 to 70 feet, Gryphaea agglomerate bed sets in and was followed around the hill.

The chalky nodular limestone above this was carefully examined for algae and ostracods but none were found - - - - - - - - - - 58' - 0"

Walnut:

#6 Chalky limestone with numerous Gryphaea marcoui - - - - - - - - - - 5' - 0"

#5 Chalky limestone with Gryphaea agglomerate - - 10' - 0"

#4 Nodular chalky limestone yellowish in color and filled with large Exogyra texana, Oxytropidoceras, Gryphaea marcoui, Protocardia, etc. - - - - - - - - - - 5' - 0"

#3 Limestone; in some places soft, other places hard - - - - - - - - - - 65' - 0"

#2 Exogyra bed - - - - - - - - - - 10' - 0"

#1 Nodular limestone - - - - - - - - - - 15' - 0"

Glen Rose -

Section #2

Bachelor Peak, Burnet County

Walnut - Comanche Peak Section

Comanche Peak :

#18	Nodular chalky limestone - - - - - - - - -	19' - 6"
#17	Marly beds (yellow clays) - - - - - - - - -	12' - 0"
#16	Chalky limestone - - - - - - - - -	9' - 0"
#15	Yellow clay containing some Exogyra texana, Gryphaea marcoui, Enallaster texanus, Cyprimeria crassa, Turritella seriatim-granulata - - - - - - - - -	8' - 3"

Walnut :

#14	Gryphaea agglomerate composed of nodular limestone breaking down into marly material and closely packed with Gryphaeas of all sizes to about 2" in length - - - - - - - - -	9' - 2"
#13	Nodular limestone ending in yellow clay below, at top are many Oxytropidoceras associated with Cyprimeria, Turritella, Exogyra texana, Gryphaea marcoui - - - - - - - - -	2' - 6"
#12	Clay (yellow) - - - - - - - - -	7' - 2"
#11	Lime ledge, marly, nodular, containing many Exogyra texana, and Gryphaea marcoui - - - - - - - - -	2' - 7"
#10	Yellow clay - - - - - - - - -	6' - 6"
#9	Gryphaea agglomerate - - - - - - - - -	0' - 4"
#8	Dark yellow clay - - - - - - - - -	4' - 7"

#7	Gryphaea agglomerate	6' - 10"
#6	Nodular limestone containing algae, Estheria (?), Protocardia texana	47' - 6"
#5	Clay with Exogyra texana	5' - 0"
#4	Limestone ledge Gryphaea agglomerate	0' - 10"
#3	Clay bench with many Gryphaea marcoui	9' - 2"
#2	Limestone ledge, Exogyra texana, Gryphaea	2' - 0"
#1	Covered with wash material	13' - 0"

Glen Rose

Section #3

Pilot Knob, Williamson County

Edwards:

#14 Limestone containing rudistids and flints cap the hill - - - - - - - - - 23' - 0"

Comanche Peak:

#13 Mainly covered but some chalky beds showing - - - - - - - - - 95' - 0"

Walnut:

#12 Nodular limestone with many Gryphaea of all sizes to about 2" in length - - - - - - - - - 5' - 0"

#11 Covered at base, rises in clays with Exogyra texana, Gryphaea marcoui, Oxytropidoceras acuto-carinatum, and Cyprimeria crassa - - - - - 30' - 0"

#10 Hard white limestone containing algae, flat-coiled foraminifera, and Estheria ? - - - - - - - - - 5' - 0"

These beds are overlain by clays with Gryphaea marcoui and Exogyra texana at their top.

#9 White chalky limestone containing foraminifera, algae, Nodosaria, and Turritella sp. Gryphaea marcoui, Lima sp., Pholadomya sancti-sabae, Neithea irregularis, and Estheria?. Top weathers into bored limestone which looks like Edwards - - - 15' - 0"

#8 Cherty limestone, containing corals, Estheria?, and foraminifera - - - - - - - - 5' - 0"

#7	Chalky, semi-crystalline, cherty beds, containing *Gryphaea marcoui*, *Pholadomya* sp., *Turritella* sp., *Nodosaria*, *Nerinea*, and *Hamites* - - - - - - - - - -	10' - 0"
#6	Soft, nodular, chalky limestone, weathers into rounded and angular pebbles. Contains *Enallaster texanus*, *Gryphaea marcoui*, *Exogyra texana*, *Tylostoma* sp., *Lima waco-ensis*, *Pholadomya* sp., *Protocardia texana*, *Pholadomya sanctisabae*, *Neithea irregularis*, and *Anchura* sp. - - - - - - - - - -	10' - 0"
#5	Clay with Exogyra texana - - - - - - - - -	5' - 0"
#4	Limestone ledge composed of *Gryphaea* agglomerate - - - - - - - - - -	4' - 0"
#3	Clay with many *Gryphaea marcoui* - - - - - -	5' - 0"
#2	Limestone ledge containing *Exogyra texana*, and *Gryphaea marcoui* - - - - - - - - - -	2' - 6"
#1	Mainly covered but some chalky beds showing - - - - - - - - - -	13' - 6"

Glen Rose -

Section #4

Mexican Cemetery on Road from

Liberty Hill to Pilot Knob

Walnut -

Metengonoceras hilli bed

#9	Bench of yellow clay - - - - - - - - - -	1' - 0"
#8	Limestone beds - - - - - - - - - -	4' - 0"
#7	Yellow clay, *Exogyra texana* - - - - - - -	3' - 0"
#6	Ledge of limestone - - - - - - - - - -	1' - 0"
#5	Yellow clay, *Exogyra texana* - - - - - - -	5' - 0"
#4	Limestone ledge and yellow clay - - -	3' - 0"
#3	Limestone ledge and yellow clay - - -	2' - 0"
#2	Slope (covered) - - - - - - - - - -	17' - 0"
#1	Limestone and clay with *Exogyra texana* - - - - - - - - - -	6' - 0"

Glen Rose -

Section #5

Between Leander and Liberty Hill on Austin - Llano Highway. Location about two miles from Leander.

Comanche Peak -

Walnut:

#13	*Gryphaea* agglomerate composed of soft nodular limestone weathering into marly material and closely packed with *Gryphaea* of all sizes. This can be seen in the road material pit just west of the highway - - - - - - - - -	9' - 0"
#12	Yellow nodular limestone with many *Oxytropidoceras* associated with *Cyprimeria*, *Turritella*, *Exogyra texana*, and *Gryphaea marcoui* - - - - - - - - -	5' - 0"
#11	Yellow clay - - - - - - - - -	7' - 2"
#10	Limestone ledge, marly, nodular, containing many *Exogyra texana* and *Gryphaea marcoui* - - - - - - - - -	2' - 7"
#9	Yellow clays - - - - - - - - -	6' - 6"
#8	Dark yellow clay with 4" ledge of *Gryphaea marcoui* agglomerate - - - - - - - - -	5' - 0"
#7	*Gryphaea* agglomerate - - - - - - - - -	7' - 4"
#6	Nodular limestone containing fossil algae, *Estheria?*, and *Protocardia texana* - - - - - - - - -	47' - 0"

#5	Clay with *Exogyra texana* - - - - - - - - -	5' - 0"
#4	Limestone ledge of *Gryphaea* agglomerate - - - - - - - - -	0' - 10"
#3	Yellow clay bed with many *Gryphaea marcoui* and *Exogyra texana* - - - - - - - - -	9' - 2"
#2	Limestone ledge with *Exogyra texana* and *Gryphaea marcoui* - - - - - - -	2' - 0"
#1	White nodular limestone - - - - - - - - -	21' - 0"

Glen Rose -

Section #6

Walnut Section

Leander - Liberty Hill, upper road. On road Leander - Bagdad, near turn to Liberty Hill in ditch with many Oxytropidoceras acutocarinatum and O. trinitensis.

On Liberty Hill section, the flats are of clays with many Gryphaea and Exogyra texana. The gravel pit on Austin - Liberty Hill road just north of Leander is in this zone. The nodular limestone with algae, Estheria?, and foraminifera occurs on a hill on the Leander - Liberty Hill road. It is more massively bedded and in places more chalky that at Twin Sisters and Bachelor's Peaks. It measures, by aneroid barometer, 47 - 50 feet. This limestone is succeeded downward by a series of thin bedded limestones about 4 or 5 inches thick separated by yellow clays containing Gryphaea and Exogyra texana. The main Exogyra texana bed is 15 feet below the nodular limestone.

The Exogyra texana bed is at the foot of the hill, so its thickness is indeterminate.

Exogyra texana bed on neighboring hill, basal bed, is 10 feet thick.

Below Exogyra bed is a series of nodular limestones and clays, chiefly nodular lime with concretionary or radial structure, 25 feet.

Glen Rose -

Section #7

West of Allen Quarry

Williamson County

Comanche Peak -

Walnut:

#9	Clays and limestone with Oxytropidoceras acutocarinatum and Gryphaea marcoui on hill near Cemetery north of Cedar Park - - - - - - - - - - - - - - - -	37' - 0"
#8	Nodular limestone, soft, chalky on hill at county line near quarry - - - - - - - -	12' - 0"
#7	Soft, chalky limestone same as before. Weathers with hole and laminae pattern; has algae present. The beds weather like Edwards, are soft, and contain univalves, rudistids,etc. Soil is chocolate colored - - - - - - - - - - - -	20' - 0"
#6	Soft, chalky limestone, massive in bed but flakes on weathering, algae present - - - - - - - - - - - - -	24' - 0"
#5	Massive rudistid limestone - - - - - - - - - -	3' - 0"
#4	Massive chalky limestone ending in bed of nodular flaky chalky limestone overlain by massive bed with Caprina, and weathering like Edwards - - - - - - - - - -	20' - 0"
#3	Nodular limestone beds - - - - - - - - - -	25' - 0"
#2	Exogyra texana beds - - - - - - - - - -	10' - 0"
#1	Lime in massive beds 14" or more with Exogyra texana, Protocardia, Tylostoma pedernalis, Nerinea, etc. - - - - - -	12' - 0"

Glen Rose -

Section # 8

Anderson Mill, Cedar Park Road

Section East Side of Cypress Creek

- - - - - -

Measurements taken in 5' intervals

Comanche Peak -

Walnut:

#30	Yellow clay limestone. It appears to be top of Walnut; contains Exogyra texana, Gryphaea marcoui, and Turritella seriatim-granulata - - - - -	2' - 6"
#29	Covered - - - - - - - - - -	5' - 0"
#28	Covered - - - - - - - - - -	5' - 0"
#27	Covered - - - - - - - - - -	5' - 0"
#26	Soft, shelly, sandy limestone - - - - - - - - -	4' - 0"
#25	Massive, oolitic limestone containing algae - - - - - - - - - -	5' - 0"
#24	Hard, crystalline limestone, shell debris. Many fossils at base. Middle hard, white crystalline with many fossils. Section massive. Top is nodular, cherty limestone - - - - - - - - - -	5' - 0"
#23	Hard, crystalline limestone at base. Hard oolitic at top contains Requienia - - - - - - - - - -	5' - 0"
#22	Thin bedded at base. Grades into massive, hard crystalline bored limestone - - - - - - - - - -	5' - 0"
#21	Same as #20 but grades into thin bedded dense crystalline limestone - - - - - - - - - -	5' - 0"

#20	Soft, oolitic limestone, compact and massive - - - - - - - - -	5' - 0"
#19	Soft, massive, crystalline limestone - - - - - - - - -	5' - 0"
#18	Beds of bored, cherty limestone ranging into crystalline limestone with Requienia - - - - - - - - -	5' - 0"
#17	Caliche, 1 foot, 4 feet of massive, bored limestone. It contains Caprina, Toucasia, and Ostracods. Rocks are both chalky and crystalline. Solid but not very hard. Looks like Edwards, but has no flint and is softer - - - - - - - - -	5' - 0"
#16	Caliche - - - - - - - - -	5' - 0"
#15	Cherty, white limestone with borings, contains small fossils - - - - - - - - -	5' - 0"
#14	Same as #13 but grading into very massive limestone beds - - - - - - - -	5' - 0"
#13	Same as #12 for about 2 feet, then grades into cherty, white, bored limestone, containing small fossils - - - - - - - - -	5' - 0"
#12	Hard, crystalline limestone with yellow blotches, contains Pholadomya sanctisabae, 8". Chalky limestone contains many small fossils, Pholadomya anchura, and Turritella, 4',4" - - - - - -	5' - 0"
#11	Mixed clay and limestone containing abundance of Exogyra texana. This is the top of the lower Exogyra texana beds - - - - - - -	5' - 0"
#10	Same as #11 - - - - - - - - -	5' - 0"
#9	Same as #10 - - - - - - - - -	5' - 0"

#8	Same as #9, base of the lower *Exogyra texana* beds	5' - 0"
#7	Hard crystalline oolitic limestone containing shell debris	5' - 0"
#6	Same as #5	5' - 0"
#5	White, oolitic limestone containing *Exogyra texana*	5' - 0"
#4	Thin bedded marly limestone containing *Tylostoma pedernalis* and *Exogyra texana*	5' - 0"
#3	Shelly limestone grading into massive limestone which is blotched with yellow specks; contains *Lima*, *Neithea irregularis*, *Exogyra texana*, and a few other small fossils	5' - 0"
#2	Hard limestone with small holes; contains algae, *Panopea* and *Tylostoma pedernalis*	4' - 0"
#1	Crystalline limestone with yellow blotches	1' - 0"

Glen Rose -

Section #9

First Trail south of Jollyville
leading to headwaters of
Bull Creek.

Edwards:

#8 Flint horizon 35 feet above basal beds.

Comanche Peak:

#7 White, shelly limestone about 10' - 0"

Walnut:

#6 Clay limestone with *Exogyra texana* *Gryphaea marcoui*, and what appears to be *Cyprimeria* - - - - - - - 10' - 0"

#5 *Oxytropidoceras acutocarinatum* in nodular clay limestone - - - - - - 10' - 0"

#4 Massive limestone beds, some of the limestones are bored and some contain *Caprina*. *Caprina* bed 25 feet from top of massive limestone - - - - - - - 50' - 0"

#3 Soft, nodular limestone - - - - - - - 35' - 0"

#2 Clay with many *Exogyra texana* - - - - - - 10' - 0"

#1 Massive limestone - - - - - - - 10' - 0"

Glen Rose -

Section #10

Walnut - Comanche Peak Section

3.5 miles northwest Bull Creek Bridge on old Burnet Road.

Edwards Cap

Comanche Peak - - - - - - - - - - - - - - - - - -

Walnut Clay:

#5	Massive cherty limestone - - - - - - - -	10' - 0"
#4	Nodular limestone - - - - - - - -	21' - 0"
#3	Nodular limestone - - - - - - - -	20' - 0"
#2	Clay with numerous Exogyra texana and small Gryphaea and 3" Gryphaea agglomerate - - - - - - - -	15' - 0"
#1	Clay layers and heavy limestone - - - - - - - -	14' - 0"

Glen Rose -

Section #11

On Road from Spicewood Springs to Bull Creek - 8 miles from Austin

Edwards -

Comanche Peak:

#5	Flaggy chalky beds - - - - - - - - - - - -	10' - 0"

Walnut:

#4	Massive limestone with Estheria?, algae, foraminifera bed, cherty limestones - - - - - - -	40' - 0"
#3	Nodular soft, chalky limestone - - - - - - - - - - - -	10' - 0"
#2	Clay with Exogyra texana and a few Gryphaea marcoui - - - - - - - - -	20' - 0"
#1	Massive limestone - - - - - - - - - - - -	10' - 0"

Glen Rose -

Section #12

On Trail leading northward from Bull Creek Road at Mt. Barker, about two miles from Main Road.

Edwards Cap -

Comanche Peak:

#4 Nodular limestone with some massive beds of limestone - - - - - - - - - 15' - 0"

Walnut:

#3 Hard, cherty limestone, in upper part weathering like Edwards, lower more flaky and nodular. The upper part contains algae. The flaky part contains many foraminifera like Miliolidae - - - - - - - - 45' - 0"

#2 Clay - contains Exogyra texana, Gryphaea marcoui, Turritella - - - - - - - - 15' - 0"

#1 Nodular limestone - - - - - - - - 5' - 0"

Glen Rose -

Section #13

Shingle Hill, Travis County

On Barton Springs - Hamilton's Pool Road, 27 miles from Austin, Texas.

Edwards:

#5	Flaggy white limestone turning dark gray on weathering. Limestone is bored and flints are found in the limestone flags - - - - - - -	2' - 6"

Comanche Peak:

#4	Soft, creamy white, flaky limestone, weathering white - - - - - - - -	38' - 0"

Walnut:

#3	Soft, creamy, nodular limestone mixed with considerable yellow clay; containing Tylostoma sp. - - - - - -	11' - 0"
#2	Yellow clays containing an abundance of Exogyra texana of all sizes; small Gryphaea marcoui, Holectypus planatus, Tylostoma sp., Protocardia texana, and Turritella sp. Also containing a 4" ledge of Gryphaea agglomerate - - - - - - - -	16' - 0"
#1	White, soft, nodular limestone weathering gray - - - - - - - -	12' - 0"

Glen Rose -

Section #14

Ranch House on Rob Roy Ranch
on Barton Springs - Hamilton's
Pool Road

Edwards:

#5 Flaggy, white limestone turning dark gray on exposure. Contains smooth algae, scattered flints on top - - - - - - - - - 20' - 0"

Comanche Peak:

#4 Creamy, flaky limestone weathering light gray - - - - - - - - - 21' - 0"

Walnut Clay:

#3 Soft, white nodular limestone, remains white on weathering - - - - - - - - 17' - 0"

#2 Yellow clay, containing an abundance of Exogyra texana, Gryphaea marcoui, Protocardia texana, Tylostoma sp. Gryphaea agglomerate 4" thick - - - - - - - - - 14' - 0"

#1 White nodular limestone weathering dark gray - - - - - - - - - 5' - 0"

Glen Rose -

Section #15

Section taken on Purgatory Creek
one half mile south
of Hugo, Hays County

Edwards -

Comanche Peak :

#4 Flaggy limestone; creamy white on fresh break, but on exposure turns dark gray - - - - - - - - - - - - 9' - 0"

Walnut:

#3 Nodular limestone somewhat cherty; weathers light brown caused by iron oxidation. - - - - - - - - - - - - 5' - 0"

#2 Yellow clay, containing an abundance of Exogyra texana, Roemer; small Gryphaea marcoui, Hill & Vaughan; Protocardia sp. - - - - - - - - - - - - 8' - 0"

#1 Nodular limestone weathering gray - - - - - - - - - - - - 5' - 0"

Glen Rose -

Section #15 A

Just over the line in Comal County

This Section is the same

as Section #15.

Section #16

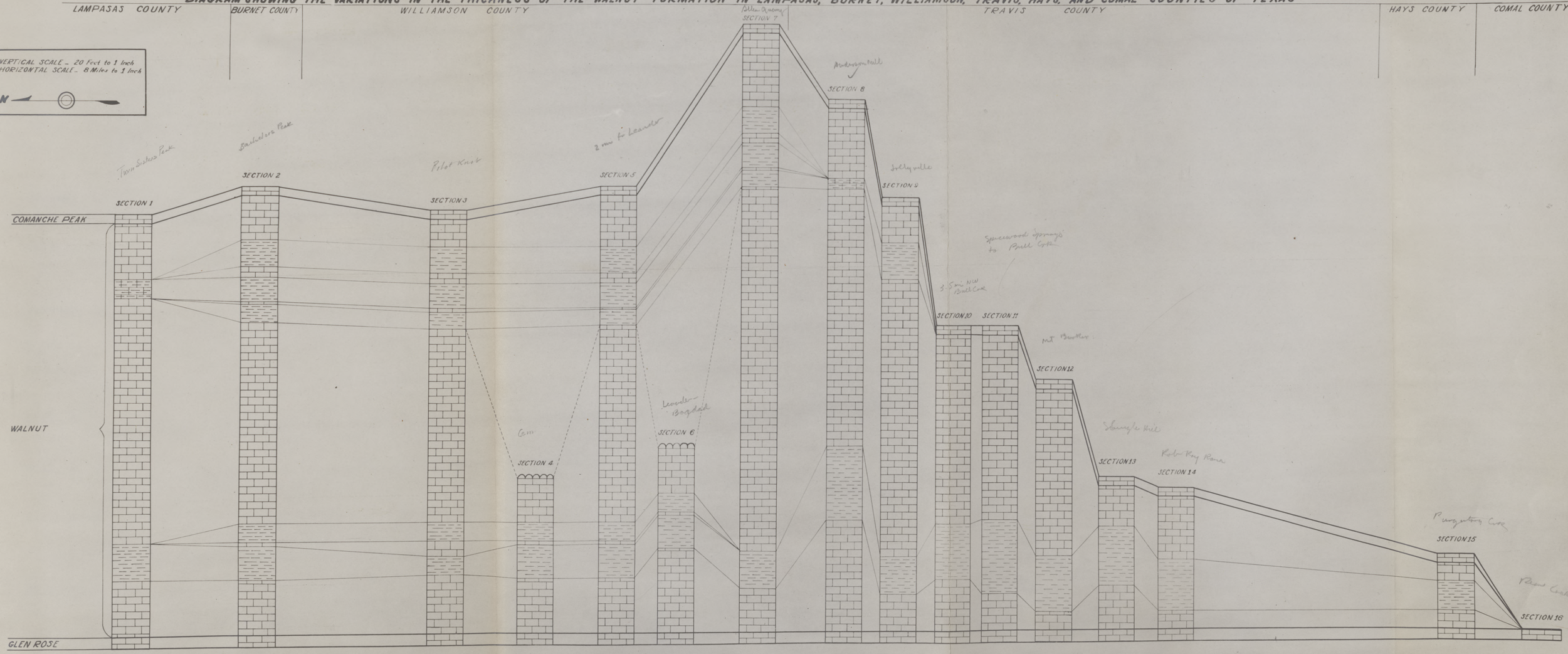
On Bear Creek, eleven miles
northwest of New Braunfels,
Comal County

The Edwards limestone lies directly on the Glen Rose limestone. A_t this place, the Walnut formation has completely disappeared. No evidence of either the Comanche Peak or Walnut formations could be found.

DIAGRAM SHOWING THE VARIATIONS IN THE THICKNESS OF THE WALNUT FORMATION IN LAMPASAS, BURNET, WILLIAMSON, TRAVIS, HAYS, AND COMAL COUNTIES OF TEXAS

LAMPASAS COUNTY | BURNET COUNTY | WILLIAMSON COUNTY | TRAVIS COUNTY | HAYS COUNTY | COMAL COUNTY

VERTICAL SCALE – 20 Feet to 1 Inch
HORIZONTAL SCALE – 8 Miles to 1 Inch
N



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